



Signal Processing with Simulink



SciEngineer's training courses are designed to help organizations and individuals close skills gaps, keep up-to-date with the industry-accepted best practices and achieve the greatest value from MathWorks® and COMSOL® Products.

Signal Processing with Simulink

This three-day course provides an understanding of how to design signal processing systems and process data in Simulink. Through basic modeling techniques and tools, it shows how to develop Simulink block diagrams for signal processing applications. This course is intended for beginning Simulink users and those looking for a review.

Prerequisites

MATLAB Fundamentals and basic knowledge of digital signal processing.

DURATION	LEVEL
3 Days	Basic
	

TOPICS

Day 1

- What is Simulink?
- Creating and Simulating a Model
- Modeling Discrete Dynamic Systems
- Modeling Logical Constructs
- From Algorithm to Mode

Day 2

- Mixed-Signal Models
- Simulink Solvers
- Subsystems and Libraries
- Conditional Subsystems
- Spectral Analysis

Day 3

- Designing and Applying Filters
- Multirate Systems
- Incorporating External Code
- Combining Models into Diagrams
- Automating Modeling Tasks

What is Simulink?

OBJECTIVE: Get an introduction to Simulink.

- What is Simulink?
- Benefits of using Simulink
- Simulink add-ons
- A look at a Simulink model

Creating and Simulating a Model

OBJECTIVE: Explore the Simulink interface and block libraries. Build a simple model and analyze the simulation results.

- Creating and editing a Simulink model
- Defining system inputs and outputs
- Simulating the model and analyzing results

Modeling Discrete Dynamic Systems

OBJECTIVE: Model discrete dynamic systems, and visualize frame-based signals and multichannel signals using a scope.

- Modeling a discrete system with basic blocks
- Finding sample times of block outputs
- Using frames in your model
- Using buffers
- Frames vs. multichannel signals
- Viewing frame-based signals
- Behavior of delay blocks with frame-based signals
- Multichannel frame-based signals

Modeling Logical Constructs

OBJECTIVE: Model logical expressions. See how zero-crossing detection is used in Simulink and model simple logic in Simulink using MATLAB code.

- Modeling logical expressions
- Modeling conditional signal routing
- Understanding zero-crossing detection
- Modeling with the MATLAB Function block

From Algorithm to Mode

OBJECTIVE: Create a model from an algorithm specification.

- Modeling from algorithmic specifications
- Iterative algorithm development through modeling and simulation
- Verifying models against specified algorithms

Mixed-Signal Models

OBJECTIVE: Model mixed-signal systems.

- What is a mixed-signal model?
- Modeling an ADC with aperture jitter and nonlinearity
- Case study: Modeling TI's ADS62P29 ADC

Simulink Solvers

OBJECTIVE: Choose the right solver for a Simulink model.

- Understanding the Simulink solver
- Solving simple models
- Solving models with discrete and continuous states
- Solving models with multiple rates
- Fixed-step and variable-step solvers
- Choosing a continuous-state system solver
- Handling zero crossings
- Handling algebraic loops

Subsystems and Libraries

OBJECTIVE: Create custom blocks in Simulink, apply masks, and develop custom libraries.

- Creating subsystems
- Understanding virtual and atomic subsystems
- Using a subsystem as a model component
- Masking subsystems
- Creating custom block libraries
- Working with and modifying library blocks
- Adding custom libraries to the Simulink Library Browser
- Creating configurable subsystems

Conditional Subsystems

OBJECTIVE: Model systems with parts that are executed conditionally.

- Conditionally executed subsystems
- Modeling condition-driven systems with enabled subsystems
- Modeling condition-driven systems with triggered subsystems
- Working with an example using the AGC model

Spectral Analysis

OBJECTIVE: Perform spectral analysis in the Simulink environment, and use spectrum computation in an algorithm.

- Performing spectral analysis with the Spectrum Scope block
- Choosing spectral analysis parameters
- Analyzing power spectrum of a motor noise
- Building a spectral classifier of speech
- Determining the frequency response of a discrete system

Designing and Applying Filters

OBJECTIVE: Incorporate filters in a model, and explore different ways filters can be designed and implemented in a Simulink model.

- Designing filters in Simulink
- Converting filters to fixed point

Multirate Systems

OBJECTIVE: Model multirate systems. Resample data and explore multirate filter blocks.

- Modeling multirate systems
- Exploring blocks for multirate signal processing
- Resampling oversampled data
- Designing and implementing anti-imaging and anti-aliasing filters
- Using multirate filter blocks
- Case study: Converting professional audio to CD format
- Converting the design to fixed point

Incorporating External Code

OBJECTIVE: Import or incorporate custom or external MATLAB and C code into a Simulink model.

- Working with custom and external code considerations Incorporating MATLAB code and C code with the MATLAB
- Function block

Combining Models into Diagrams

OBJECTIVE: Explore model integration, an important topic for large-scale projects in which several developers are developing different portions of a large system.

- Exploring model referencing and subsystems
- Setting up a model reference
- Setting up model reference arguments
- Exploring model reference simulation modes
- Viewing signals in referenced models
- Browsing the model reference dependency graph

Automating Modeling Tasks

OBJECTIVE: Control and run Simulink models from the MATLAB command line.

- Automating test runs
- Checking and modifying parameter settings
- Finding blocks with specific parameter values
- Constructing and modifying block diagrams



**Expand your
knowledge**

